Pavement Management

Pavement Rehabilitation Manual

VOLUME I: PAVEMENT EVALUATION

MATERIALS BUREAU
NEW YORK STATE DEPARTMENT OF TRANSPORTATION
Mario M. Cuomo, Governor/Franklin E. White, Commissioner

PAVEMENT REHABILITATION MANUAL

VOLUME I: PAVEMENT EVALUATION

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MATERIALS BUREAU
New York State Department of Transportation
Albany, New York 12232

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APPENDICES

SAFETY

The Pavement Evaluation Survey takes place in a potentially hazardous location. Dense, high speed traffic areas are particularly dangerous. Consequently, attention to safety is paramount.

Pavement evaluators should assess the risks and consult with their Region Safety Coordinator to plan and arrange backup support where necessary.

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David W. Bernard
William J. Cuerdon
Daniel K. Fregoe
William M. McCarty
Richard H. Obuchowski
William A. Snyder
Thomas E. Wohlscheid
Wayne J. Brule
Gary A. Frederick
Robert D. Manz
Richard D. McKeon
Linda M. Ross
Frederick S. Szczepanek

SCOPE

Volume I of the Pavement Rehabilitation Manual contains uniform procedures for determining the condition of pavement and shoulders. Also included are standard forms that have been developed for collecting project information and pavement and shoulder distress data.

Volume II of the manual, entitled Treatment Selection, shows how the collected distress data is used to select appropriate rehabilitation alternatives and develop life cycle costs for the alternatives. Also, included is an example of a pavement evaluation report that is prepared for the client once the above described analysis is completed.

These volumes supersede "The Pavement Evaluation And Rehabilitation Manual" published by the Materials Bureau in March 1984.

INTRODUCTION

The success of a pavement rehabilitation treatment is dependent upon choosing the best treatment for the intended repair. In order to choose the best treatment, it is necessary to analyze alternate treatments. A proper analysis of alternatives requires a thorough evaluation of the existing pavement, shoulders, foundation and drainage.

The appropriate time to perform a pavement evaluation is when a project is initiated. The advantage of having the information at this time is:

1. Alternate rehabilitation treatments can be evaluated to analyze estimated cost versus length of expected service.

2. Adequate funds can be programed for the project.

Candidate projects for rehabilitation are usually identified either by the Highway Maintenance Resident Engineer or by the network condition survey rating. The actual condition of the pavements may range from pavements that are in poor condition and require significant work to pavements that are in good condition and need only preventative maintenance.

GENERAL PROCEDURE

The general procedure for evaluating the condition of pavements include the following steps:

1. Acquire project information from records which provide history, features and related data on the pavement.

2. Perform a field distress survey on the pavement and shoulders.

3. Obtain information from the Highway Maintenance Resident Engineer on the pavement, shoulder, foundation and drainage performance.

4. Perform a field investigation of the pavement, shoulders, foundation and drainage as necessary.

5. Prepare a report on the condition.

PROJECT INFORMATION

The project information shall be collected using a standard format developed for this pavement evaluation procedure. This information will identify the proposed project, provide history of the pavement, list roadway features, and provide related pavement data. The information should be available from records in the Region Office. The information shall be collected before making the field survey and should be checked during the field survey. The form for collecting project information is in Figure 1.

PAVEMENT AND SHOULDER CONDITION SURVEY

The evaluation procedure shall consist of making a field survey of the proposed project and collecting data on the severity and extent of major forms of distress that appear in the pavement and shoulders.

The field survey should be completed by a team of two people as described on pages 2 and 4; one to drive and collect data, the other to collect and record data.

The field survey shall be performed when the entire pavement and shoulder surfaces are visible. If the survey is performed when frost is in the ground, this condition should be noted since the frost can magnify the distress.

The location of the information collected from the pavement in the field survey shall be identified by the reference marker system. If reference markers don't exist, other readily discernable permanent features such as structures, cross-roads, interchanges etc. should be used to identify locations.

Distress Data Collection

The data shall be collected using a standard format developed for this pavement survey procedure. This format provides assurance that all components of the roadway relating to the pavement and shoulders are evaluated and that the distress is described in standard terminology.

Procedures for collecting data on the severity and extent of distress in pavements and shoulders are in the Appendices as follows:

Appendix A - General Instructions
Appendix B - Rigid Pavement
Appendix C - Flexible Pavement or Flexible/Rigid Pavement
Appendix D - Shoulders

Initially, the survey team shall ride the entire proposed project at or near the posted speed limit to obtain an overview of the pavement and shoulder condition. A determination shall be made on whether the distress is relatively uniform in severity and extent along the full length of the proposed project or if the distress is localized.

After the ride-through at posted speed, the surveyors shall ride the entire proposed project on the shoulder, if possible, at a slow speed (5 mph) to observe all forms of distress in the pavement and shoulders. At this speed, some of the major forms of pavement distress and foundation problems are apparent and shall be recorded as to type of distress and location. Also, isolated distress is noted and collected during this second ride through.

PAVEMENT EVALUATION REPORT

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

PROJECT INFORMATION

General

Region: ____ **County:** ________ **Route No:** ______ **PIN** ______

Project Identification: ____________________________________

____

Begin RM ________ **End RM** ________ **Total Length:** ________

Original Contract Date(s): ______________________________

Latest Pavement Rehabilitation Date(s): ______________________

____

Roadway Features

Roadway: Divided ______ Non-Divided ______
Median: Flush ______ Raised ______ Concrete Median Barrier ______
Curbs: Mountable ______ Non-Mountable ______
AC ______ PCC ______ Stone ______

Pavement:
Lanes: No. ______ Width(s) ______
Type: Reinforced PCC ______ Non-Reinforced PCC ______
AC ______ AC over PCC ______
Thickness (nominal): Total ______ (AC ____ PCC ____)
Reinforced and Non-Reinforced PCC Pavements only:
Slab Length ______
Load Transfer Type: Dowels ______ 2 Component ______
Transverse Joints: Contraction ______ Expansion ______

Subbase:
Type: ______________ Thickness (nominal): ______________

Shoulders:
Type: AC ______ PCC ______ Gravel ______ Thickness ______
AC or Surface Treatment/Stabilized Gravel ______ Thickness ______
Width: Both ______ Driving Lane ______ Passing Lane ______

Drainage:
Type: Open System ______ Closed System ______

Related Pavement Data

Traffic AADT (Range) ____________ Date __________ % Trucks ______
Sufficiency Rating (Range) ______ Date __________

Prepared By ______________ Date ______

Figure 1

The next step will take place on the third drive-through by stopping on the shoulder and collecting detail condition data for pavement and shoulders. This should be done at the first *one-tenth mile section in each one-half mile interval* of the proposed project.

The location of the one-tenth mile section shall be identified by reference markers or by other means previously stated. If all or part of the one-tenth mile section falls on a bridge deck, approach slab, or at an at-grade intersection, the one-tenth mile section shall be moved ahead in the one-half mile interval until all the one-tenth mile section is located beyond these areas.

Under normal circumstances, the pavement condition data shall be collected as follows:

Roadway Type	Area Surveyed
Multi-lane, divided or undivided	Driving lane and right shoulder, both directions
Two-lane, two-way	One lane and adjacent shoulder
Ramps and one lane roadways	Pavement and right shoulder

If the lanes are not uniform in condition across the roadway, data shall also be collected from the additional lane(s) to represent the pavement.

An example would be a four lane divided portland cement concrete pavement where the driving lanes exhibit considerably more distress than the passing lanes.

Following the collection of distress data, the severity and extent shall be determined for each distress type indicated on the form. If some distress types do not occur, the form shall indicate that none exists. The extent of most types of distress will be described as a percentage, numerical count, or its presence in the section. Forms for distress data collection for the various pavement types and shoulders are shown in Figures 2 and 3.

Highway Maintenance Input

The Highway Maintenance Resident Engineer shall be consulted to obtain information concerning the influence of the seasons, which may not be apparent at the time of the pavement survey. The consultation should include the level of maintenance required on the subject pavement and shoulders and locations (identified by reference markers) of drainage problems, frost heaves, settlements or other foundation problems. The information from the consultation shall be documented and it shall become part of the condition report.

Field Investigations

At times in-depth field investigations will be warranted to determine the cause of some types of distress. These would usually include coring the pavement or shoulders or investigating foundation or drainage problems. The Regional Materials Engineer is

available for investigating pavement problems and the Regional Soils Engineer is available for investigating the shoulders, roadway foundation and drainage. The information and data (in summary form) and conclusions obtained from the investigation shall be part of the condition report.

Full-depth pavement cores provide additional information on condition and makeup of underlying pavement layers. Usually only a few cores are necessary to provide such information for a treatment decision. If conditions are uniform, coring in a typical area will be representative of the entire project. Where conditions are extremely diverse, a core in each area is desirable. Cores may have an impact on the repair method chosen. Cores are valuable for the following reasons:

Distress	Information	Decision
RIGID		
Spalling	Depth affected	Full- or partial-depth repair
Cracks	Depth, concrete condition, mesh location and condition	Full- or partial-depth repair, working or nonworking cracks
Faulted Transverse Joints	Type and condition of load-transfer device	Full- or partial-depth repair, forecast performance
Asphalt Concrete Overlay Patching	Condition and depth of overlay and underlying concrete pavement	Overlay or remove, repair, and overlay
FLEXIBLE or FLEXIBLE OVER RIGID		
Cracking	Type, thickness and condition of overlay; lab tests for layer properties	Overlay or mill and overlay, recycle
Rutting	Type, thickness and condition of layers; lab tests for layer properties	Overlay or mill and overlay, recycle or mill and inlay
Widening	Identify widening and pavement differences; type, thickness, and condition of layers	Overlay or remove, repair, and overlay
Asphalt Concrete Overlay Patching	Condition and depth of overlay, condition of underlying layers	Overlay or remove, repair, and overlay

Condition Report

The information obtained from the pavement survey, consultation with the Highway Maintenance Resident Engineer and any field investigation shall be condensed into a final condition report. The report shall state the severity and extent of each type of distress appearing in the pavement, shoulders and foundation. Drainage deficiencies should also be included. Figure 4 shows a brief outline of the format of the condition report.

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NYSDoT MATERIALS BUREAU

DISTRESS DATA FORM

PAVEMENT

RIGID [X]

Region ____ County ________ Route No. ______ Pin ________

Number of Lanes ____ Survey Pertinent to ____ Lane(s) ______ Direction ______

Date Insp. ______ Inspectors ________________ Sheet ____ of ____

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning								
		Ending								
SETTLEMENTS & HEAVES (#)	N	None								
	P	Present								
BLOWUPS (#)	Partial Width									
	Full Width									
ASPHALT CONC. OVERLAY PATCHING (#)	N	None								
	G	Good								
	F	Fair								
	P	Poor								
JOINT SEALER FAILURE ✓	N	None								
	F	Failed								
TRANSVERSE JOINT FAULTING (MEASURE) ✓	N	None								
	L	<3/8"								
	M	3/8"–3/4"								
	H	>3/4"								
TRANSVERSE JOINT SEPARATION (#)										
TRANSVERSE JOINT DISTRESS (# JOINTS)	N	No Spalls								
	L	Minor 3" max. Width								
	M	Occs. >3" Width								
	H	Many >3" Width								
LONGITUDINAL JOINT SEPARATION (#)										
LONGITUDINAL JOINT DISTRESS (# SLABS)	N	No Spalls								
	L	Minor 2" max. Width								
	M	Occs. >2" Width								
	H	Many >2" Width								
SLAB CRACKING (# SLABS)	N	None								
	L	Light								
	M	Moderate								
	H	Heavy								
WHEELPATH RUTTING (MEASURE) ✓	N	None								
	L	< 3/8"								
	M	3/8"–3/4"								
	H	>3/4"								
SCALING/ NON–JOINT SPALLING (# SLABS)	N	None								
	L	Light								
	M	Medium								
	H	Heavy								

SHOULDER SURVEY PERTINENT TO: BOTH [ ] RIGHT [ ] LEFT [ ]

DISTRESS		SEVERITY	(1)	(2)	(3)	(4)	(5)	SUM	%	REMARKS
SHOULDER DETERIORATION ✓	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
LANE/SHOULDER SEPARATION (MEASURE) ✓	N	None								
	L	< 1/4"/Sealed								
	M	1/4"– 1"								
	H	> 1"								
LANE/SHOULDER DROPOFF (MEASURE) ✓	N	None								
	L	< 1"								
	M	1"–2"								
	H	>2"								
SHOULDER DEFORMATION ✓	N	None								
	P	Present								

Figure 2

NYSDoT MATERIALS BUREAU

DISTRESS DATA FORM

Region ______ County ______________ Route No. ________ Pin ______________

Number of Lanes______ Survey Pertinent to_____ Lane(s) ________ Direction ________

Date Insp. ________ Inspectors ______________________________ Sheet _____ of _____

PAVEMENT
FLEXIBLE ☐
FLEXIBLE/RIGID ☐

DISTRESS		SEVERITY	SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning								
		Ending								
CORRUGATIONS (%)	N	None								
	P	Present								
SETTLEMENTS & HEAVES (#)	N	None								
	P	Present								
ASPHALT CONC. OVERLAY OR SPRAY PATCH (#)	N	None								
	G	Good								
	F	Fair								
	P	Poor								
WHEELPATH CRACKING (%)	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
FULL WIDTH TRANSVERSE CRACKING (#)	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
LONGITUDINAL CRACKING (%)	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
EDGE CRACKING (%)	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
CRACKING OTHER (%)	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
SLIPPAGE CRACKS ☑	N	None								
	P	Present								
RAVELLING (%)	N	None								
	P	Present								
WHEELPATH RUTTING (MEASURE) ☑	N	None								
	L	< 3/8"								
	M	3/8"–3/4"								
	H	>3/4"								
WIDENING DROPOFF (MEASURE) ☑	N	None								
	L	<3/8"								
	M	3/8"–3/4"								
	H	>3/4"								

SHOULDER SURVEY PERTINENT TO: BOTH ☐ RIGHT ☐ LEFT ☐

DISTRESS		SEVERITY	(1)	(2)	(3)	(4)	(5)	SUM	%	REMARKS
SHOULDER DETERIORATION ☑	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
LANE/SHOULDER SEPARATION (MEASURE) ☑	N	None								
	L	< 1/4"/Sealed								
	M	1/4"– 1"								
	H	> 1"								
LANE/SHOULDER DROPOFF (MEASURE) ☑	N	None								
	L	< 1"								
	M	1"–2"								
	H	>2"								
SHOULDER DEFORMATION ☑	N	None								
	P	Present								

Figure 3

Pavement	**Summarize severity and extent for each type of distress appearing in the pavement.**
Shoulders	**Summarize severity and extent for each type of distress appearing in the shoulders.**
Foundation	Summarize foundation problems.
Drainage	Summarize drainage problems.

Figure 4 - Condition Report Outline

APPENDIX A

General Instructions for Completing Distress Data Forms

APPENDIX A

This appendix gives general instructions for completing the Distress Data Forms. The instructions are outlined from top to bottom of the form and are broken-down into five major parts:

1. Heading
2. Pavement Section Surveyed
3. Distress Data Collection Procedure
4. Remarks
5. Shoulder Survey Heading

HEADING

The heading information is identical for all pavement type distress data forms. The following details the information to be recorded in the heading.

Region, County, and Route No. - Pertinent to the survey location.

Direction - The direction of travel while conducting the survey. This should be reported as (North, South, East, or West). For undivided highways this identifies which lane is used for conducting the detailed survey. For example, a two way East/West roadway for which the direction of travel is east would have the Eastbound lane and its adjacent shoulder used to conduct the detailed survey.

PIN - Project Identification Number. A previously determined number to identify the proposed project to be surveyed.

Number of Lanes - The total number of lanes in both directions on an undivided highway or the total number of lanes in the direction of the survey on a divided highway. If the highway is divided, denote it with a (D) after the number of lanes.

Survey Pertinent to _____ Lane(s) - The lane(s) that exhibit the distress indicated on the form, and which lanes they are.
(All - all lanes; DL - driving lane; CL - center lane; ML -median lane.)

See Figures A1 and A2 for examples of typical heading completions.

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DISTRESS DATA FORM

PAVEMENT

Region *1* County *Saratoga* Route No. *187* Pin *158753* RIGID [X]

Number of Lanes *3(D)* Survey Pertinent to *2* Lane(s) *DL&CL* Direction *North*

Date Insp. *3/13/90* Inspectors *B. Alert, B. Careful* Sheet *1* of *6*

Figure A1

Figure A1 is an example of a six-lane divided highway. The survey was conducted on the northbound lanes and was pertinent to only two of the three lanes, those being the driving lane (DL) and the center lane (CL). The median lane (ML) did not exhibit the same types and/or severity levels of distress as the other lanes and, therefore, would be surveyed separately.

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NYSDoT MATERIALS BUREAU

DISTRESS DATA FORM

PAVEMENT

Region *1* County *Essex* Route No. *22* Pin *175252* FLEXIBLE [X]

Number of Lanes *2* Survey Pertinent to *2* Lane(s) *All* Direction *South* FLEXIBLE/RIGID [ ]

Date Insp. *3/13/90* Inspectors *D. Bond, D. Lamb* Sheet *1* of *4*

Figure A2

Figure A2 is an example of a two lane undivided highway. The survey was conducted on the southbound lane and was pertinent to both north and southbound lanes, both lanes exhibited similar distress.

PAVEMENT SECTION SURVEYED

Record the 4 digits from the bottom row of the roadside reference marker. These numbers shall be recorded for both the beginning and ending point of each half mile section. The detailed survey will then be conducted on the first tenth mile segment of the half mile sections, unless the tenth mile segment is obstructed with a bridge or intersection as previously explained under Distress Data Collection. See Figure A3 for a typical example.

DISTRESS	SEVERITY	SECTION						EXTENT TOTAL		REMARKS
			(1)	(2)	(3)	(4)	(5)			
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*	SUM	%	

Figure A3

DISTRESS DATA COLLECTION PROCEDURE

Each distress category and severity level is defined under the distress descriptions in Appendices B-D. These appendices should be referred to for the specific method of measuring and determining the severity and extent of distress. Photos are included to aid in determining the different levels.

Three different methods of recording distress and severity are used as follows:

1. Percentage Estimation (%)
2. Numerical Count (#)
3. Indication of Presence (√)

The method used to record the extent of distress is indicated by the symbols above on the Distress Data Form and also is explained in Appendices B-D under How to Measure.

1. *Percentage Estimation* - is used primarily on the Flexible Pavement or Flexible/Rigid Pavement distress data form (Figure 3). The percentage concept is used to estimate the percentage of a particular type of distress and severity level that exists within the tenth mile detailed survey pavement length affected. Refer to the distress descriptions (Appendices B-D) for the specific method of measuring and determining the severity and extent of distress. The estimated percentage is documented on the data form by entering a number from 1 to 10 in the appropriate boxes; 1 represents 10%, 2 represents 20%, up to 10 which represents 100%. If no distress is present in a detailed survey section a 10 (100%) is recorded in the <u>None</u> box. Note - for each type of distress the summation of the individual severity levels for each tenth mile section evaluated should equal 10. See Figure A4 for a typical example.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020	SUM	%	
		Ending	1005	1010	1015	1020	1025			
WHEELPATH CRACKING (%)	N	None	6		1			7	14	
	L	Single Crack	4	8	5	6	5	28	56	
	M	Multiple Cracks		2	4	4	5	15	30	
	H	Mult. Cracks w/Potholes						0	0	

Figure A4

2. *Numerical Count* - is used for those forms of distress that are discrete in their occurrences, such as settlements and heaves, blowups, transverse joint distress, etc. Each level of severity should be counted and noted for the appropriate distress categories. Refer to the distress descriptions (Appendices B-D) for the specific method of measuring and determining the severity and extent of distress. Some forms of distress are counted within the tenth mile detail survey section only, while others are counted for the entire half mile survey section. If no distress is present, indicate this with a checkmark in the None box. See Figure A5 for a typical example.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020	SUM	%	
		Ending	1005	1010	1015	1020	1025			
FULL WIDTH TRANSVERSE CRACKING (#)	N	None	✓							
	L	Single Crack		III	II			5		
	M	Multiple Cracks			IIII	IIII	~~IIII~~ I	14		
	H	Mult. Cracks w/Potholes				II		2		

Figure A5

3. *Indication of Presence* - For this method of measuring and recording distress use a checkmark in the appropriate distress category and severity level. Refer to the distress descriptions (Appendices B-D) for the specific methods of measuring and determining the severity level present. If no distress is present, indicate this with a checkmark in the None box. See Figure A6 for a typical example.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020	SUM	%	
		Ending	1005	1010	1015	1020	1025			
WHEELPATH RUTTING (MEASURE) ☑	N	None	✓					1	20	
	L	< 3/8"		✓	✓		✓	3	60	
	M	3/8"–3/4"				✓		1	20	
	H	>3/4"						0	0	

Figure A6

Extent Totals - After the entire project has been evaluated the ratings for each section shall be summed up for each individual severity level and the total placed in the summation box on the last form. For some distress types that are measured by either using a Percentage Estimation, Numerical Count or an Indication of Presence (checkmark, ✓), a percent of distress is calculated.

For those distress categories where project percentages would be misleading such as a non-uniform type of distress, the percent column is blacked out and therefore should not be calculated, but should be summarized in the Condition Report.

REMARKS

Any narrative remarks concerning a section should be made in this space referring to the section by the numbers indicated in the parenthesis under the section heading. Remarks could include differences in distress levels from one lane to another, unusual road conditions not recorded on the form, differences in distress levels between right and left shoulders, or any information that the survey team feels may be pertinent to the survey. See Figure A7 for a typical example.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025	SUM	%	
EDGE CRACKING (%)	N	None	10	10	4	2	3	29	58	(3)M–Severity
	L	Single Crack			4	8	6	18	36	Level Assco.
	M	Multiple Cracks			2		1	3	6	With Rt. Pav't.
	H	Mult. Cracks w/Potholes						0	0	Edge only

Figure A7

SHOULDER SURVEY HEADING

Check off which side(s) exhibits the distress indicated on the form. See Figure A8 for a typical example.

SHOULDER SURVEY PERTINENT TO: BOTH [✓] RIGHT [ ] LEFT [ ]

Figure A8

SHOULDER DISTRESS DATA COLLECTION PROCEDURE

This section is completed following the same directions outlined for the pavement distress data collection. Refer to Appendix D for specific methods of measuring and determining the severity and extent of shoulder distress.

APPENDIX B

Distress Data Collection Procedures
Rigid Pavement

SETTLEMENTS AND HEAVES

Description: Settlements are localized pavement surface areas having elevations slightly lower than those of the surrounding pavement. Heaves are localized upward displacements of the pavement surface. (Figure B1)

Causes:

1. Frost action (heaves)
2. <u>Settlement</u> of the base

Severity Levels: No degrees of severity are defined. Settlements and heaves should be noted only when they have a noticeable effect on the ride.

How to Measure: Record the number of settlements and/or heaves counted in each half mile survey length.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025	SUM	%	
SETTLEMENTS & HEAVES (#)	N	None	✓	✓			✓			
	P	Present			l	l		2		

% Calculation Not Required

Typical Bridge Approach Settlement

Figure B1 - Settlements and Heaves

BLOWUPS

Description: A localized buckling or shattering of a slab generally occurring at a transverse joint or crack which may or may not have been patched with bituminous concrete. (Figure B2)

Causes: An infiltration of fines in unsealed transverse joints which acts as an incompressible medium. This incompressible medium will buildup due to the normal contraction which takes place in cold weather and the infiltration of abrasive sand and roadway dirt. The normal expansion during warmer weather will cause compressive stresses which are relieved when the pavement buckles or shatters.

Since blowups may not occur in all the lanes of a multilane pavement, shearing forces develop in the longitudinal joints as lanes move independently. These forces cause longitudinal tie bars to bend and shear off. Once the lanes are no longer tied together, further separation occurs at the longitudinal joint as infiltration continues.

Severity Levels: A partial width blowup occurs in one or some of the lanes of a multilane pavement. It does not extend across the full pavement width. Adjacent transverse joints will be seen to be misaligned as the slabs move toward the pressure relief caused by the blowup. A full width blowup occurs across the entire pavement width and does not cause transverse joint misalignment.

How to Measure: Tally and note number in each category in each half mile survey length.

DISTRESS	SEVERITY	SECTION	(1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025	SUM	%	
BLOWUPS (#)	Partial Width			✓	✓	|	|	2		
	Full Width		|					1		

% Calulation Not Required

Blowup Showing
Shattered Concrete
Before Repair

Partial Width Blowup That Occurred In The Near Lanes Only And Has Been Repaired With Asphalt Concrete

Figure B2 - Blowups

ASPHALT CONCRETE OVERLAY PATCHING

Description: A lane or full pavement width, paver laid, asphalt concrete patch placed to improve rideability over localized distress. May be over one or two slabs or several hundred feet long. (Figure B3)

Causes: A localized settlement and/or excessively cracked, scaled or spalled pavement slab.

Severity Levels:

Good — Like new. Original condition of asphalt concrete overlay.

Fair — Underlying problem reflecting through. Cracks showing, potholes, spot patching by Maintenance forces.

Poor — No longer serviceable, extensive deterioration has reflected through or the asphalt concrete has deteriorated to the extent where replacement is necessary.

How to Measure: Tally and note approximate length of each patch under remarks in each half mile survey length.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
	Beginning		1000	1005	1010	1015	1020			
	Ending		1005	1010	1015	1020	1025			
ASPHALT CONC. OVERLAY PATCHING (#)	N	None		✓	✓	✓				(1) 120'Long-DL
	G	Good								(5) 180' & 240'
	F	Fair					II	2		Long-DL
	P	Poor	I					1		

% Calculation Not Required

Good

Fair

Poor

Figure B3 - Asphalt Concrete Overlay Patching

JOINT SEALER FAILURE

Description: Liquid Sealers - Failure is characterized by loss of bond (adhesion) between the sealer and joint faces, internal tearing (cohesion) within the sealer itself and/or entrapment of incompressibles within the sealer matrix and/or loss of sealer from the joint. (Figure B4)

Preformed Neoprene Sealers - Failure is characterized by loss of recovery from a compressed state (compression set) and/or internal web sticking, allowing the infiltration of water and incompressibles into the joint and/or loss of sealer from the joint.

Causes: When the major portion of New York's PCC pavements were being constructed in the 1960's, little was known about the relationship between joint width and slab length. In addition, the joint sealers available at the time lacked the flexibility and recoverability characteristics needed to perform satisfactorily for an extended period of time when exposed to environmental extremes. This lack of knowledge also extended to construction, resulting in inadequate joint groove preparation prior to sealing, and poor sealer installation practices. Consequently, joint sealers failed within a short period of time. To further complicate this problem, maintenance and replacement of failed joint sealers with suitable materials has been practically non-existent.

Severity Levels: Determine through observation whether or not joint sealers have failed.

In some instances sealer failure is unmistakably evident, as the entire sealer may be missing. However, many times sealers appear to be functioning but, in fact, have exceeded their serviceable life. This generally occurs if observations are made during warm periods when pavement joints are at their narrowest because of slab expansion. At this time of year, gaps caused by cohesion failure, loss of adhesion and compression set may not be discernable. However, they can easily be detected with a thin bladed putty knife or similar instrument used as a probe to detect these gaps. It is also very helpful to cut and remove a section of sealer from the joint. This allows inspection of the joint grooves and liquid sealers for infiltration of incompressibles and the inspection of preformed sealers for compression set.

How to Measure: Check category which represents tenth mile detail survey section.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
JOINT SEALER FAILURE ☑	N	None						0	0	
	F	Failed	✓	✓	✓	✓	✓	5	100	

$$\% = \frac{\text{Sum of Checkmarks per Severity Level}}{\text{Sum of Number of Sections Evaluated}} \times 100$$

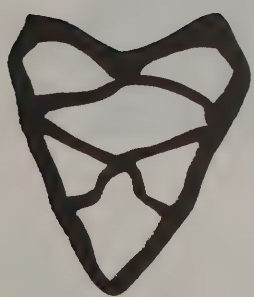
Liquid Sealer Adhesion Failure

Liquid Sealer
Cohesion Failure

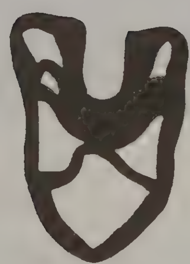
Preformed Neoprene Sealer Broken From Stretching During Installation

Preformed Neoprene Sealer
Compression Set Failure
Allowing The Infiltration
Of Incompressible Materials

Incompressible Infiltration In A Liquid Sealer



New Preformed Neoprene Sealer



Failed, Preformed Neoprene Sealer

(Compression Set, Web Sticking)

Figure B4 - Joint Sealer Failure

TRANSVERSE JOINT FAULTING

Description: Differential vertical displacement of abutting slabs at joints or slab cracks creating a step deformation on the pavement surface. (Figure B5)

Causes: Loss of load transfer caused by a combination of; unsealed joints, which allow water and deicing salts to penetrate, traffic loads and load transfer device design. Salts cause corrosion of the malleable iron type load transfer device which are weakened due to metal loss and fail due to traffic loads. The water weakens the base which is displaced by traffic loadings in the area. Faulting progresses with time as base material is displaced due to water and continuing traffic loads.

Severity Levels:

Low	Elevation difference less than 3/8"
Medium	Elevation difference between 3/8" and 3/4"
High	Elevation difference greater than 3/4"

How to Measure: Measurement should be taken 1 foot from the edge of the pavement lane with a combination square as shown in the photo. Measure to the nearest 1/8 inch at 2 transverse joints, during the tenth mile detail survey. Checkmark the category in which the average of the measurements fall as shown in the example.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
TRANSVERSE JOINT FAULTING (MEASURE) ☑	N	None						0	0	
	L	<3/8"	✓	✓		✓		3	60	
	M	3/8"–3/4"			✓			1	20	
	H	>3/4"					✓	1	20	

$$\% = \frac{\text{Sum of Checkmarks per Severity Level}}{\text{Sum of Number of Sections Evaluated}} \times 100$$

Figure B5 - Transverse Joint Faulting

TRANSVERSE JOINT SEPARATION

Description: Increase in joint width from the time the joint was originally constructed. (Figure B6)

Causes: Infiltration of incompressible material during the contraction cycle of the pavement slabs. As slabs move toward blowups and/or pressure relief joints, space is provided for continued infiltration increasing widening.

How to Measure: The number of joints in each tenth mile detail survey, 1 1/2 inches or greater in width are tallied.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*	SUM	%	
TRANSVERSE JOINT SEPARATION (#)			𝍸 II			IIII	𝍸	*16*	*35*	

$$\% = \frac{\text{Sum of Joints (Counts)}}{\text{*9 Joints/Section X Number of Sections}} \times 100$$

** 9 Joints/Section is based on 60 ft. long slabs. If different slab lengths are encountered, evaluate the tenth mile section (500 ft.) but change the number of joints appropriately in the denominator for calculating %.*

Figure B6 - Transverse Joint Separation

TRANSVERSE JOINT DISTRESS

Description: <u>Spalling</u>

A piece of concrete joint edge which has cracked and broken away from the slab. Spalls may range in size from minor chips to large pieces constituting major joint damage. Spalls usually do not extend through the thickness of the slab but meet the joint at an angle. Spalls may be patched with asphalt concrete or a concrete material. (Figure B7)

Causes:

Spalling is due to an internal or external force on concrete which causes it to fracture.

An internal force due to metal corrosion and/or expansion of absorptive aggregates will cause spalling.

An external force, such as a stone or other incompressible caught in the joint between expanding slabs, will create enough stress to cause chipping or a large piece of concrete to break away. Ice expanding in a crack will also cause stress and result in spalling.

Severity Levels:

Low: A minor spall with a maximum width dimension of three inches. This dimension is measured from the joint face to the edge of the spall. Chipping of the joint face would fall in this category. Joints with chipping or minor spalls as defined above would be able to be sealed with a poured sealer.

Medium: Two or less spalls per joint whose width dimension is greater than the 3 inches in the Low severity level. A joint falling in this category would be able to be sealed with a pourable sealer after the spalls are permanently repaired.

High: Three or more spalls per joint whose width dimension is greater than the 3 inches in the Low severity level. A joint falling in this category is so extensively deteriorated that the most cost effective solution may be asphalt patching followed by an asphalt overlay.

(Continued)

TRANSVERSE JOINT DISTRESS
(Continued)

How to Measure:

The number of joints falling in each severity level are tallied during the tenth mile detail survey as shown in the example.

DISTRESS	SEVERITY		SECTION (1)	SECTION (2)	SECTION (3)	SECTION (4)	SECTION (5)	EXTENT TOTAL SUM	EXTENT TOTAL %	REMARKS
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*			
TRANSVERSE JOINT DISTRESS (# JOINTS)	N	No Spalls						*0*	*0*	
	L	Minor 3" max. Width			IIII			*4*	*9*	
	M	Occs. >3" Width	卌	卌 II	卌	卌 IIII	IIII	*30*	*67*	
	H	Many >3" Width	IIII	II			卌	*11*	*24*	

$$\% = \frac{\text{Sum of Joints (Counts) per Severity Level}}{\text{9 Joints/Section X Number of Sections}} \times 100$$

Low

Medium

High

Note the severity of wheelpath wear as shown by the varying degrees of exposed large aggregates in the three examples above.

Figure B7 - Transverse Joint Distress

LONGITUDINAL JOINT SEPARATION

Description: Increase in joint width from the time the joint was originally constructed. (Figure B8)

Causes: Failure of the longitudinal joint ties between pavement lanes due to corrosion, infiltration, and independent movement of pavement lanes (See Blowups).

How to Measure: The number of pavement slabs (60 feet nominal) in each tenth mile detail survey, where the longitudinal joints have widened to 1 inch or greater in width are tallied.

DISTRESS	SEVERITY	SECTION	(1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	EXTENT TOTAL %	REMARKS
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*			
LONGITUDINAL JOINT SEPARATION (#)			𝍸 II			IIII	𝍸	*16*	*40*	

$$\% = \frac{\text{Sum of Slabs (Counts)}}{\text{*8 Sixty ft. Slabs/Section X Number of Sections}} \times 100$$

** 8 Slabs/Section is based on sixty ft. long slabs. If different slab lengths are encountered, evaluate the tenth mile section (500 ft.) but change the number of slabs appropriately in the denominator for calculating %.*

Figure B8 - Longitudinal Joint Separation

LONGITUDINAL JOINT DISTRESS

Description: See Transverse Joint Distress and Figure B9

Causes: See Transverse Joint Distress

Severity Levels:

Low — Minor spalls or chipping with a maximum width dimension of two inches. Joints at this severity level would be able to be sealed with a pourable sealer.

Medium — Two or less spalls per sixty foot length of pavement having a width dimension greater than two inches. A joint falling in this category would be able to be sealed with a pourable sealer after the spalls are permanently repaired.

High — Three or more spalls per sixty foot length of pavement having a width dimension greater than two inches. A length of pavement falling in this category is so extensively deteriorated that the most cost effective solution may be asphalt patching followed by an asphalt overlay.

How to Measure: The number of pavement slabs (60 feet nominal) falling in each severity level are tallied during the tenth mile detail survey.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
LONGITUDINAL JOINT DISTRESS (# SLABS)	N	No Spalls		III	~~IIII~~	IIII	~~IIII~~ III	20	50	
	L	Minor 2" max. Width	~~IIII~~	IIII	II	III		14	35	
	M	Occs. >2" Width	II	I	I	I		5	13	
	H	Many >2" Width	I					1	2	

$$\% = \frac{\text{Sum of Slabs (Counts)}}{\text{8 Sixty ft. Slabs/Section X Number of Sections}} \times 100$$

Low

Medium

High

Figure B9 - Longitudinal Joint Distress

SLAB CRACKING

Description:

A crack or cracks within a pavement slab that propagate in any direction. Cracks may vary from hairline to more than one inch in width. (Figure B10)

Causes:

Slab cracking is common. It may occur either early in the life of a pavement or later after the pavement has been subjected to the action of the environment and traffic loading. Cracking that occurs early can usually be attributed to shrinkage and curling stresses, poor construction practices such as improper handling and placement of load transfer devices, improper curing and/or sawing joints too late. Cracking occurring later can usually be attributed to load transfer lockup or loss, loss of subbase support and/or excessive loading.

Severity Levels:

Low — Cracks less than 1/8" in width generally free of spalls, have not faulted and/or do not open and close with changes in temperature.

Medium — Cracks 1/8" or greater in width generally free of spalls and/or have not faulted that can be effectively cleaned, and sealed.

High — Cracks 1/8" or greater in width which are spalled and/or faulted and cannot be effectively cleaned and sealed. Generally slabs containing cracks of this magnitude should be broken and seated and overlaid or replaced.

How to Measure:

Tally and note the number of cracked slabs that are in each category in the tenth mile long detail survey section.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
SLAB CRACKING (# SLABS)	N	None	𝍸 III	𝍸 III	𝍸	III		24	60	
	L	Light					𝍸	5	12	
	M	Moderate					III	3	8	
	H	Heavy			III	𝍸		8	20	

$$\% = \frac{\text{Sum of Slabs (Counts)}}{\text{8 Sixty ft. Slabs/Section X Number of Sections}} \times 100$$

Low

Medium

High

Figure B10 - Slab Cracking

WHEELPATH RUTTING

Description: Loss of mortar and fine aggregate resulting in the exposure and polishing of the larger aggregate and rutting in the wheelpaths of the pavement surface disrupting cross-slope drainage. (Figure B11)

Causes: Wear due to winter abrasives and wheel repetitions.

Severity Levels:

Low	Average rut depth less than 3/8 inch
Medium	Average rut depth of 3/8 - 3/4 inch
High	Average rut depth of greater than 3/4 inch

How to Measure: Measure depth to the nearest 1/8 inch, in right hand wheel path, at one location during tenth mile detail survey. Checkmark category in which measurement falls.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*			
WHEELPATH RUTTING (MEASURE) ☑	N	None						*0*	*0*	
	L	< 3/8"	✓	✓	✓		✓	*4*	*80*	
	M	3/8"–3/4"				✓		*1*	*20*	
	H	>3/4"						*0*	*0*	

$$\% = \frac{\text{Sum of Checkmarks per Severity Level}}{\text{Sum of Number of Sections Evaluated}} \times 100$$

Figure B11 - Wheelpath Rutting

SCALING NON-JOINT SPALLING

Description: Irregularities in the pavement slab surface other than those occurring at joints and characterized by scaling, popouts and/or spalling. These distress types may be patched with asphalt. (Figure B12)

Causes: Scaling is caused by excessive water used in finishing the concrete's surface or lack of proper amount of entrained air, in combination with freezing and thawing.

Popouts are caused by expansive or absorptive coarse aggregate which spalls the concrete surface.

A common example of spalling is corrosion of pavement reinforcing mesh which causes a spall in the pavement surface. This is prevalent when the cover over the mesh is shallow.

Severity Levels:

Low: Minor isolated scaling less than one half inch deep and/or popouts. No spalling.

Medium: Scaling ½ to 1 inch deep and/or two or less spalls per slab. (spalls are noted only if greater than 1 square foot in area)

High: Scaling greater than 1 inch deep. Three or more spalls per slab.

How to Measure: Observe and tally the number of slabs (60 ft.) that fall in each severity level during the one-tenth mile detail survey.

DISTRESS	SEVERITY			SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
			Beginning	1000	1005	1010	1015	1020			
			Ending	1005	1010	1015	1020	1025			
SCALING/ NON-JOINT SPALLING (# SLABS)	N	None		卌 III	卌 III	卌 III	卌 I	卌 II	37	92	(4) scaling
	L	Light					II		2	5	(5) spalling
	M	Medium						I	1	3	
	H	Heavy							0	0	

$$\% = \frac{\text{Sum of Slabs (Counts)}}{\text{8 Sixty ft. Slabs/Section X Number of Sections}} \times 100$$

Low Spalling

Popouts

Medium Scaling

Showing Deterioration Of Mortar

Heavy Spalling

Due To Corrosion Product Expansive Pressure And Shallow Concrete Cover Of The Reinforcing Mesh.

Figure B12 - Scaling Non-Joint Spalling

BR-47(6/90) NYSDoT MATERIALS BUREAU

DISTRESS DATA FORM

Region *12* County *Excelsior* Route No. *99* Pin *1201.50*

Number of Lanes *2(D)* Survey Pertinent to *2* Lane(s) *All* Direction *North*

Date Insp. *3/13/90* Inspectors *A. Hunt, W. Judge*

Sheet *1* of *1*

PAVEMENT RIGID [X]

DISTRESS		SEVERITY	(1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
SETTLEMENTS & HEAVES (#)	N	None	✓	✓			✓			
	P	Present			I	I		2		
BLOWUPS (#)		Partial Width				I	I	2		
		Full Width	I					1		
ASPHALT CONC. OVERLAY PATCHING (#)	N	None		✓	✓	✓				(1) 120' Long-DL
	G	Good								(5) 180' Long-DL
	F	Fair					II	2		240' Long-DL
	P	Poor	I					1		
JOINT SEALER FAILURE ✓	N	None	✓					1	20	
	F	Failed		✓	✓	✓	✓	4	80	
TRANSVERSE JOINT FAULTING (MEASURE) ✓	N	None						0	0	
	L	<3/8"	✓	✓		✓		3	60	
	M	3/8"–3/4"			✓			1	20	
	H	>3/4"					✓	1	20	
TRANSVERSE JOINT SEPARATION (#)			𝍸 II			IIII	𝍸	16	35	
TRANSVERSE JOINT DISTRESS (# JOINTS)	N	No Spalls						0	0	
	L	Minor 3" max. Width			IIII			4	9	
	M	Occs. >3" Width	𝍸	𝍸 II	𝍸	𝍸 IIII	IIII	30	67	
	H	Many >3" Width	IIII	II			𝍸	11	24	
LONGITUDINAL JOINT SEPARATION (#)						𝍸	𝍸	10	25	
LONGITUDINAL JOINT DISTRESS (# SLABS)	N	No Spalls		III	𝍸	IIII	𝍸 III	20	50	
	L	Minor 2" max. Width	𝍸	IIII	II	III		14	35	
	M	Occs. >2" Width	II	I	I	I		5	13	
	H	Many >2" Width	I					1	2	
SLAB CRACKING (# SLABS)	N	None	𝍸 III	𝍸 III	𝍸	III		24	60	
	L	Light					𝍸	5	12	
	M	Moderate					III	3	8	
	H	Heavy			III	𝍸		8	20	
WHEELPATH RUTTING (MEASURE) ✓	N	None						0	0	
	L	< 3/8"	✓	✓	✓		✓	4	80	
	M	3/8"–3/4"				✓		1	20	
	H	>3/4"						0	0	
SCALING/ NON-JOINT SPALLING (# SLABS)	N	None	𝍸 III	𝍸 III	𝍸 III	𝍸 I	𝍸 II	37	92	(4) scaling
	L	Light				II		2	5	(5) spalling
	M	Medium					I	1	3	
	H	Heavy						0	0	

SHOULDER SURVEY PERTINENT TO: BOTH [ ] RIGHT [ ] LEFT [ ]

			(1)	(2)	(3)	(4)	(5)	SUM	%	REMARKS
SHOULDER DETERIORATION ✓	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
LANE/SHOULDER SEPARATION (MEASURE) ✓	N	None								
	L	<1/4"/Sealed								
	M	1/4"–1"								
	H	>1"								
LANE/SHOULDER DROPOFF (MEASURE) ✓	N	None								
	L	< 1"								
	M	1"–2"								
	H	>2"								
SHOULDER DEFORMATION ✓	N	None								
	P	Present								

APPENDIX C

Distress Data Collection Procedures
Flexible Pavement or Flexible/Rigid Pavement

This section includes asphalt overlays on flexible as well as on rigid pavement

CORRUGATIONS

Description:

Corrugations are series of ripples occurring at fairly regularly spaced intervals perpendicular to the pavement centerline. They usually occur at points where traffic accelerates and decelerates. (Figure C1)

Possible Causes:

Traffic action combined with:

1. Pavement that has poor stability properties
2. Excessive moisture in the base
3. Contaminated asphalt

Severity Levels:

No degrees of severity are defined. Corrugations should be noted only when they affect the ride.

How to Measure:

Estimate the percentage of the 500 foot section affected. If significant differences exist between lanes note under remarks.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
CORRUGATIONS (%)	N None		10	10	9	10	10	49	98	
	P Present				1			1	2	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$

Figure C1 - Corrugations

SETTLEMENTS AND HEAVES

Description: Settlements are localized pavement surface areas having elevations slightly lower than those of the surrounding pavement. Heaves are localized upward displacements of the pavement surface. (Figure C2)

Possible Causes:

1. Settlement of the base
2. Frost action (heaves)

Severity Levels: No degrees of severity are defined. Settlements and heaves should be noted only when they affect the ride.

How to Measure: Record as the number of settlements and/or heaves counted in each half mile survey length.

DISTRESS	SEVERITY	SECTION	(1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
SETTLEMENTS & HEAVES (#)	N None		✓		✓	✓	✓			
	P Present			II				2		

% Calculation Not Required

Severe Heave

Figure C2 - Settlements And Heaves

ASPHALT CONCRETE OVERLAY OR SPRAY PATCH

Description: A partial lane, a lane or full pavement width of asphalt concrete or spray patch placed to improve rideability over localized distress areas. (Figure C3)

Possible Causes: A localized settlement and/or excessive surface distress.

Severity Levels:

Good	Good condition, asphalt concrete overlay shows no signs of distress.
Fair	Underlying problem reflecting through, such as cracks showing, potholes, spot secondary patching, etc.
Poor	Poor condition, extensive cracking, potholes and/or ravelling. Patch replacement necessary.

How to Measure: Tally and note approximate length of each patch under remarks in each half mile survey length.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
ASPHALT CONC. OVERLAY OR SPRAY PATCH (#)	N	None	✓	✓		✓	✓			(3) 500′ long–EB
	G	Good			II			2		1000′ long
	F	Fair								both lanes
	P	Poor								

% Calculation Not Required

Good

Fair

Poor

Figure C3 - Asphalt Concrete Overlay Or Spray Patch

WHEELPATH CRACKING

Description: Visible fractures or separations only within the wheelpaths (approximately 3 feet wide per wheelpath). The cracking begins as single or multiple longitudinal cracks. After repeated traffic loading the cracks connect, forming many-sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are normally less than 1 foot on the longest side. (Figure C4)

Possible Causes: Wheelpath cracking is a load related failure of the pavement. Any one or combination of the following may result in wheelpath cracking:

1. Unstable base
2. Inadequate drainage
3. Insufficient pavement thickness
4. Degradation and/or stripping in the asphalt concrete

Severity Levels:

- **Low** — Single Crack. This includes cracks that are effectively sealed.
- **Medium** — Multiple cracks ravelled. This includes cracks that have been effectively sealed.
- **High** — Multiple cracks which have pieces broken or missing (potholes).

How to Measure: Estimate the percentage of the 500 foot section affected. One wheelpath that is cracked for the entire length would represent 100 percent, or cracking over entire length, changing from one wheelpath or lane to another, would also represent 100 percent.

DISTRESS	SEVERITY		SECTION (1)	SECTION (2)	SECTION (3)	SECTION (4)	SECTION (5)	EXTENT TOTAL SUM	EXTENT TOTAL %	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
WHEELPATH CRACKING (%)	N	None	6		1			7	14	
	L	Single Crack	4	8	5	6	5	28	56	
	M	Multiple Cracks		2	4	4	5	15	30	
	H	Mult. Cracks w/Potholes						0	0	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$

Low

Medium

High

Figure C4 - Wheelpath Cracking

FULL WIDTH TRANSVERSE CRACKING

Description: Visible fractures or separations of the pavement surface perpendicular to the pavement centerline. On overlaid pavements, these cracks can be associated with the underlying transverse contraction and/or expansion joints. They will have uniform spacing, usually 20 feet, 60 feet or 100 feet depending on the PCC pavement joint spacing design. Thermal cracks are similar on the surface in flexible pavement. (Figure C5)

Possible Causes:

1. Shrinkage due to temperature changes and/or hardening of the asphalt. (Thermal cracks)
2. Frost action.
3. Base settlement or movement.
4. Movement of the underlying concrete slab in either a horizontal or vertical direction overstresses the asphalt concrete overlay resulting in a reflection crack. Movements in the concrete slab are due to temperature fluctuations and loading.

Severity Levels:

Low — Single crack. This includes a crack that is effectively sealed.

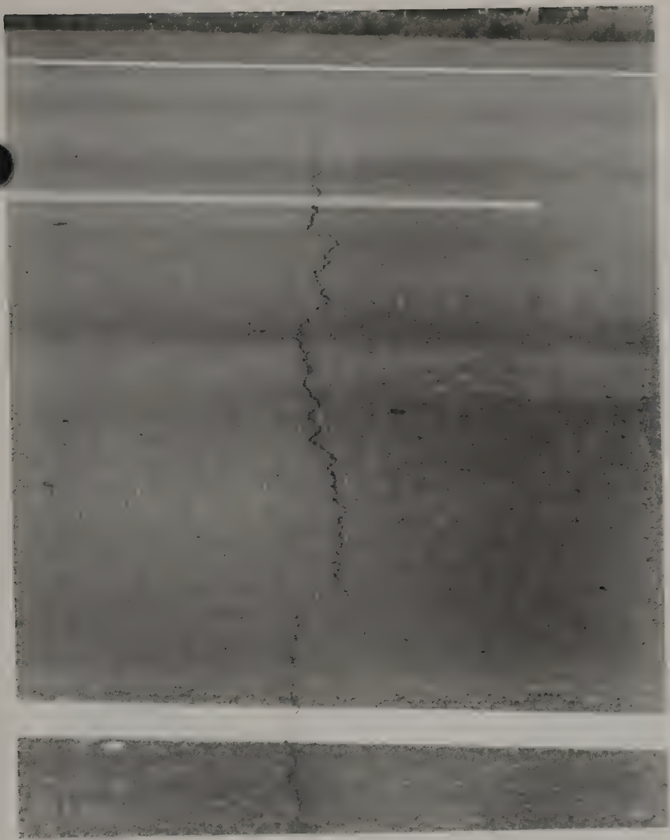
Medium — Multiple cracks that may be ravelled. This includes cracks that have been effectively sealed.

High — Multiple cracks which have pieces broken or missing (potholes).

How to Measure: Record the number of cracks occurring at each severity level within the 500 foot section.

DISTRESS	SEVERITY			SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
			Beginning	1000	1005	1010	1015	1020			
			Ending	1005	1010	1015	1020	1025			
FULL WIDTH TRANSVERSE CRACKING (#)	N	None		✓							
	L	Single Crack			III	II			5		
	M	Multiple Cracks				IIII	IIII	~~IIII~~ I	14		
	H	Mult. Cracks w/Potholes					II		2		

% Calculation Not Required



Low

High

Figure C5 - Full Width Transverse Cracking

LONGITUDINAL CRACKING

Description: Visible fractures or separations of the pavement surface parallel to the pavement centerline and at least 20 feet in length. This does not include cracks in the wheelpaths (3 feet wide per wheelpath) or cracks within 1 to 2 feet of the edge of pavement. (Figure C6)

Possible Causes:

1. A poorly constructed paving lane joint.
2. Reflection cracking from an underlaying PCC joint.

Severity Levels:

Low — Single crack. This includes cracks that are effectively sealed.

Medium — Multiple cracks that may be ravelled. This includes cracks that have been effectively sealed.

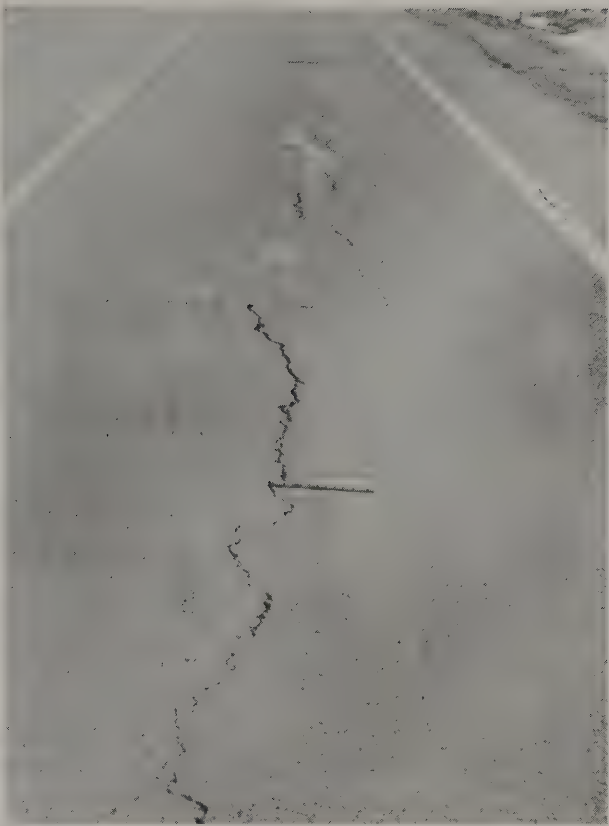
High — Multiple cracks which have pieces broken or missing (potholes).

How to Measure: Estimate the percentage of the 500 foot section affected. One crack extending the entire length would represent 100 percent.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
LONGITUDINAL CRACKING (%)	N	None	10	10			2	22	44	
	L	Single Crack			8	6	1	15	30	
	M	Multiple Cracks			2	4	7	13	26	
	H	Mult. Cracks w/Potholes						0	0	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$

Low



Medium

High

Figure C6 - Longitudinal Cracking

EDGE CRACKING

Description: These are longitudinal cracks within 1 to 2 feet of the edge of the pavement with or without transverse cracks branching towards the pavement edge. (Figure C7)

Possible Causes:

1. Lack of lateral (shoulder) support
2. Base failure
3. Frost action
4. Inadequate drainage

Severity Levels:

Low — Single crack. This includes cracks that are effectively sealed.

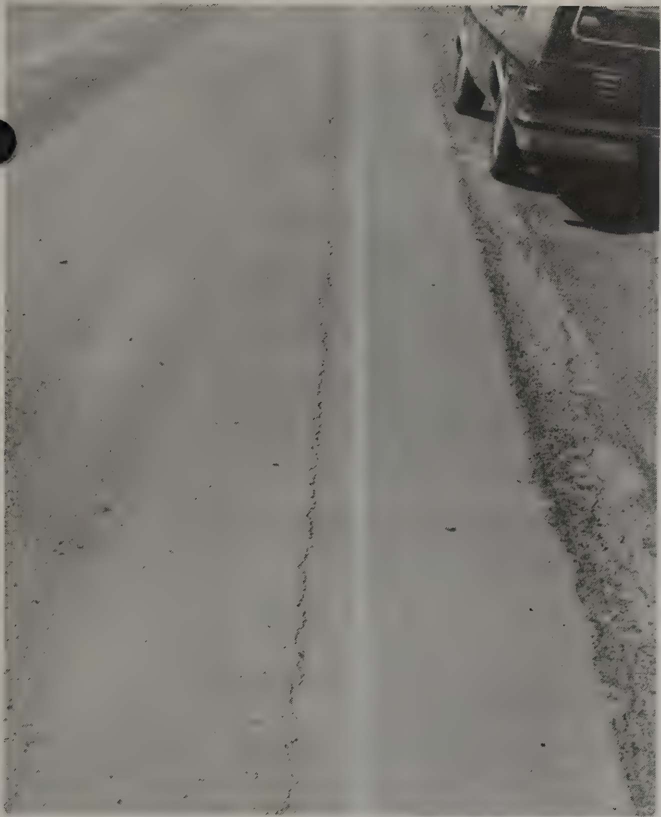
Medium — Multiple cracks that may be ravelled. This includes cracks that have been effectively sealed.

High — Multiple cracks which have pieces broken or missing (potholes).

How to Measure: Estimate the percentage of the 500 foot section affected. Rate the right-hand edge with respect to the survey direction. If significant difference in the left-hand edge exists, note under remarks.

DISTRESS	SEVERITY		SECTION (1)	SECTION (2)	SECTION (3)	SECTION (4)	SECTION (5)	EXTENT TOTAL SUM	EXTENT TOTAL %	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
EDGE CRACKING (%)	N	None	10	10	4	2	3	29	58	
	L	Single Crack			4	8	6	18	36	
	M	Multiple Cracks			2		1	3	6	
	H	Mult. Cracks w/Potholes						0	0	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$



Low

Medium

High

Figure C7 - Edge Cracking

CRACKING (OTHER)

Description:

Visible fractures or separations of the pavement surface either <u>Longitudinal</u> (parallel to the pavement centerline), less than 20 feet in length; <u>Transverse</u> (perpendicular to the pavement centerline), less than full width, or <u>Block Cracking</u> (a series of interconnecting cracks forming rectangular blocks ranging in size from 1 square foot to 20 square feet). The cracking (other) category does not include cracks in the wheelpaths (3 foot areas) or within 2 feet of the edges of the pavement. (Figure C8)

Possible Causes:

1. Shrinkage due to temperature changes and/or hardening of the asphalt.
2. Frost action.
3. Settlement or movement (does not apply to Block Cracking).
4. Poor construction practice in the fabrication of pavement joints.
5. Reflective cracks caused by cracks beneath the surface.

Severity Levels:

Low — Single crack. This includes cracks that are effectively sealed.

Medium — Multiple cracks that may be ravelled. This includes cracks that have been effectively sealed.

High — Multiple cracks which have pieces broken or missing (potholes).

How to Measure:

Estimate the percentage of the 500 foot section affected. Measurement should be rated on the worst lane. If significant differences exist between lanes, it should be noted under remarks.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
	Beginning		1000	1005	1010	1015	1020			
	Ending		1005	1010	1015	1020	1025			
CRACKING OTHER (%)	N	None	10	8				18	36	
	L	Single Crack		2	7	5	2	16	32	
	M	Multiple Cracks			3	4	7	14	28	
	H	Mult. Cracks w/Potholes				1	1	2	4	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$

Low

Medium

High

Figure C8 - Cracking (Other)

SLIPPAGE CRACKS

Description: Slippage cracks are crescent or half-moon shaped cracks produced by vehicles breaking or turning their wheels causing the pavement surface to slide or deform. (Figure C9)

Possible Causes:

1. Poor bond between the surface and lower layer of the pavement.
2. Low stability mix can also contribute to debonding of pavement layers causing slippage cracks.

Severity Levels: No degrees of severity are defined. Slippage cracks shall be noted whenever they are present.

How to Measure: When slippage cracks are present note them with a checkmark.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	*1000*	*1005*	*1010*	*1015*	*1020*			
		Ending	*1005*	*1010*	*1015*	*1020*	*1025*			
SLIPPAGE CRACKS ☑	N None		✓	✓		✓	✓	*4*	*80*	*(3) 50' long–both*
	P Present				✓			*1*	*20*	*lanes–Int. Rte.4*

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Figure C9 - Slippage Cracks

RAVELLING

Description: Ravelling is the progressive deterioration of the pavement surface caused by the dislodging of aggregate particles. (Figure C10)

Possible Causes:

1. Poor quality mixture.
2. Traffic action on a weak surface.
3. Asphalt binder has hardened appreciably resulting in poor aggregate to asphalt adhesion.

Severity Levels: No degrees of severity are defined. Ravelling should only be noted when there is an extensive loss of coarse aggregate.

How to Measure: Estimate the percentage of the 500 foot section affected.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
RAVELLING (%)	N	None	10	10	8	10	10	48	96	
	P	Present			2			2	4	

$$\% = \frac{\text{Sum of Section Percentages}}{\text{Number of Sections Evaluated}} \times 10$$

Figure C10 - Ravelling

WHEELPATH RUTTING

Description:

Longitudinal surface depressions in the wheelpaths (approximately 3 feet wide per wheel path). Pavement uplift may occur along the sides of the rut. In many instances, ruts are not easily noticeable, therefore a measurement should always be taken. (Figure C11)

Possible Causes:

Wheelpath rutting may be a load related failure of the pavement or merely result from pavement wear. Any one or combination of the following may result in wheelpath rutting.

1. Insufficient pavement thickness
2. Unstable base
3. Insufficient compaction during construction
4. Pavement wear or loss due to abrasive action of traffic

Severity Level:

Low — Average rut depth of less than 3/8 inch

Medium — Average rut depth of 3/8 - 3/4 inch

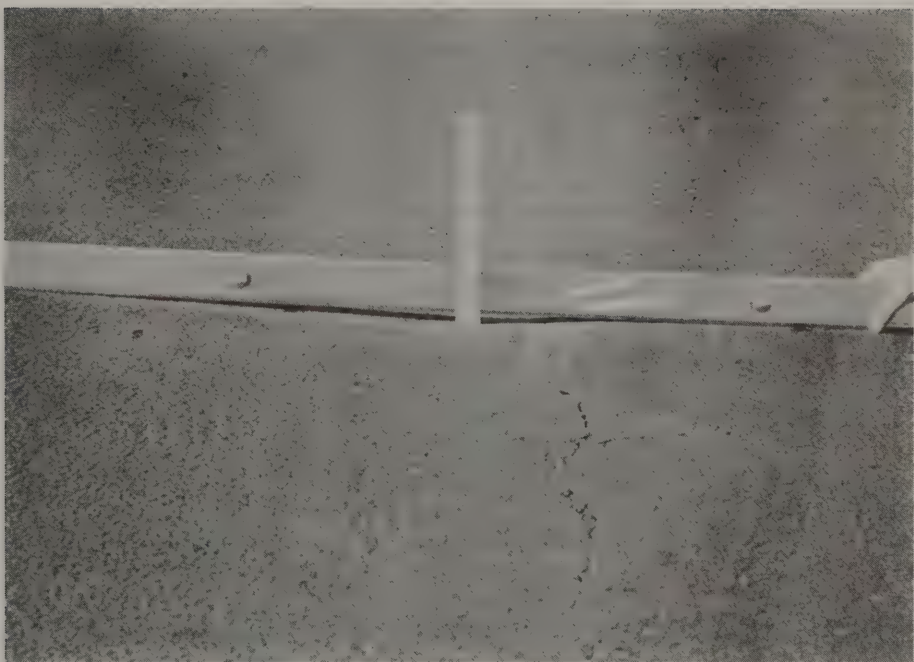
High — Average rut depth of greater than 3/4 inch

How to Measure:

Measure depth to the nearest 1/8 inch, in right hand wheelpath, at one location during tenth mile detail survey. Checkmark category in which measurement falls.

DISTRESS	SEVERITY			SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
			Beginning	1000	1005	1010	1015	1020	SUM	%	
			Ending	1005	1010	1015	1020	1025			
WHEELPATH RUTTING (MEASURE) ☑	N	None		✓					1	20	
	L	< 3/8"			✓	✓		✓	3	60	
	M	3/8"–3/4"					✓		1	20	
	H	>3/4"							0	0	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$



Medium

Figure C11 - Wheelpath Rutting

WIDENING DROPOFF

Description: A widening dropoff is a difference in elevation across the longitudinal joint between the original pavement and the widening. (Figure C12)

Possible Causes:

1. Consolidation of the widening due to traffic loadings.
2. Movement of the base underneath the widening.

Severity Levels:

Low	Dropoff is less than 3/8 inch
Medium	Dropoff is between 3/8 - 3/4 inch
High	Dropoff is greater than 3/4 inch

How to Measure: Note presence in the 500 foot section.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
WIDENING DROPOFF (MEASURE) ☑	N	None	✓	✓		✓	✓	4	80	
	L	<3/8"			✓			1	20	
	M	3/8"–3/4"						0	0	
	H	>3/4"						0	0	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Figure C12 - Widening Dropoff

BR-48(6/90)

NYSDoT MATERIALS BUREAU

DISTRESS DATA FORM

Region 13 County Empire Route No. 101 Pin 1230.50

Number of Lanes 2 Survey Pertinent to 2 Lane(s) All Direction East

Date Insp. 3/19/90 Inspectors B. Aware, D. Bond Sheet 1 of 4

PAVEMENT
FLEXIBLE [X]
FLEXIBLE/RIGID [ ]

DISTRESS		SEVERITY	SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
CORRUGATIONS (%)	N	None	10	10	9	10	10	49	98	
	P	Present			I			1	2	
SETTLEMENTS & HEAVES (#)	N	None	✓		✓	✓	✓			
	P	Present		II				2		
ASPHALT CONC. OVERLAY OR SPRAY PATCH (#)	N	None	✓	✓		✓	✓			(3) 500' long-EB
	G	Good			II			2		1000' long
	F	Fair								both lanes
	P	Poor								
WHEELPATH CRACKING (%)	N	None	6		1			7	14	
	L	Single Crack	4	8	5	6	5	28	56	
	M	Multiple Cracks		2	4	4	5	15	30	
	H	Mult. Cracks w/Potholes						0	0	
FULL WIDTH TRANSVERSE CRACKING (#)	N	None	✓							
	L	Single Crack		III	II			5		
	M	Multiple Cracks			IIII	IIII	卌 I	14		
	H	Mult. Cracks w/Potholes				II		2		
LONGITUDINAL CRACKING (%)	N	None	10	10			2	22	44	
	L	Single Crack			8	6	1	15	30	
	M	Multiple Cracks			2	4	7	13	26	
	H	Mult. Cracks w/Potholes						0	0	
EDGE CRACKING (%)	N	None	10	10	4	2	3	29	58	
	L	Single Crack			4	8	6	18	36	
	M	Multiple Cracks			2		1	3	6	
	H	Mult. Cracks w/Potholes						0	0	
CRACKING OTHER (%)	N	None	10	8				18	36	
	L	Single Crack		2	7	5	2	16	32	
	M	Multiple Cracks			3	4	7	14	28	
	H	Mult. Cracks w/Potholes				1	1	2	4	
SLIPPAGE CRACKS ☑	N	None	✓	✓		✓	✓	4	80	(3) 50' long-both
	P	Present			✓			1	20	lanes-Int. Rte.4
RAVELLING (%)	N	None	10	10	8	10	10	48	96	
	P	Present			2			2	4	
WHEELPATH RUTTING (MEASURE) ☑	N	None	✓					1	20	
	L	< 3/8"		✓	✓		✓	3	60	
	M	3/8"-3/4"				✓		1	20	
	H	>3/4"						0	0	
WIDENING DROPOFF (MEASURE) ☑	N	None	✓	✓		✓	✓	4	80	
	L	<3/8"			✓			1	20	
	M	3/8"-3/4"						0	0	
	H	>3/4"						0	0	

SHOULDER SURVEY PERTINENT TO: BOTH [ ] RIGHT [ ] LEFT [ ]

DISTRESS		SEVERITY	(1)	(2)	(3)	(4)	(5)	SUM	%	REMARKS
SHOULDER DETERIORATION ☑	N	None								
	L	Single Crack								
	M	Multiple Cracks								
	H	Mult. Cracks w/Potholes								
LANE/SHOULDER SEPARATION (MEASURE) ☑	N	None								
	L	< 1/4"/Sealed								
	M	1/4"- 1"								
	H	> 1"								
LANE/SHOULDER DROPOFF (MEASURE) ☑	N	None								
	L	< 1"								
	M	1"-2"								
	H	>2"								
SHOULDER DEFORMATION ☑	N	None								
	P	Present								

APPENDIX D

Distress Data Collection Procedures
Shoulders

SHOULDER DETERIORATION

Description: Deterioration is characterized by surface and/or structural distress in paved shoulders only, causing cracking and/or potholes. (Figure D1)

Possible Causes: Deterioration of shoulders is generally caused by the same factors that deteriorate pavements. Refer to Wheelpath Cracking, Edge Cracking, Cracking (Other), and Ravelling.

Severity Levels:

- **Low** — Single crack (which may include some secondary cracking) at the pavement/shoulder joint.
- **Medium** — Multiple cracking at the pavement/shoulder joint and outside shoulder edge.
- **High** — Potholes, severe cracking over entire shoulder.

How to Measure: Generally, rate the right-hand shoulder. If a significant difference exists in left-hand shoulder, note under remarks. Checkmark the appropriate category.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025	SUM	%	
SHOULDER DETERIORATION ☑	N	None	✓	✓	✓	✓		4	80	
	L	Single Crack						0	0	
	M	Multiple Cracks					✓	1	20	
	H	Mult. Cracks w/Potholes						0	0	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Low

Medium

High

Figure D1 - Shoulder Deterioration

LANE/SHOULDER SEPARATION

Description: Lane/Shoulder separation is a widening of the joint between the traffic lane and the shoulder which allows infiltration of water into the pavement and shoulder's base. (Figure D2)

Possible Causes:

1. Outward movement of the shoulder
2. Movement of the curb

Severity Levels: Severity level is determined by the width of the joint opening, or the opening between the pavement and curb.

Low — Joint separation is less than 1/4 inch

Medium — Joint separation is between 1/4 - 1 inch

High — Joint separation is greater than 1 inch

How to Measure: Generally, rate the right-hand shoulder. If a significant difference exists in left-hand shoulder, note under remarks. Checkmark the appropriate category.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	%	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
LANE/SHOULDER SEPARATION (MEASURE) ☑	N	None						0	0	
	L	< 1/4"/Sealed						0	0	
	M	1/4"– 1"				✓	✓	2	40	
	H	> 1"	✓	✓	✓			3	60	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Low (AC Pavement)

High (AC Pavement)

High
(PCC Pavement)

Figure D2 - Lane/Shoulder Separation

LANE/SHOULDER DROPOFF

Description: Lane/Shoulder dropoff is a difference in elevation between the pavement edge and the shoulder. (Figure D3)

Possible Causes:

1. Loss of underlying fines due to water pumping action.
2. Consolidation or settlement of the base material.
3. Loss of surface material on unpaved shoulders.

Severity Levels:

Low — The difference in elevation between the pavement edge and the shoulder is less than 1 inch.

Medium — The difference in elevation is 1 - 2 inches.

High — The difference in elevation is greater than 2 inches.

How to Measure: Generally, rate the right-hand shoulder. If a difference exists in the left-hand shoulder, note under remarks.
Checkmark the appropriate category.

DISTRESS	SEVERITY		(1)	(2)	(3)	(4)	(5)	EXTENT TOTAL SUM	EXTENT TOTAL %	REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025			
LANE/SHOULDER DROPOFF (MEASURE)☑	N	None	✓	✓	✓			3	60	
	L	< 1"						0	0	
	M	1"–2"				✓	✓	2	40	
	H	>2"						0	0	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Figure D3

Lane/Shoulder Dropoff

SHOULDER DEFORMATION

Description: Deformations are distortions in the shoulder cross section. This includes washouts, ruts, settlements, and heaves. (Figure D4)

Possible Causes:

1. Unstable base
2. Insufficient pavement thickness
3. Poor construction materials
4. Water intrusion

Severity Levels: No degrees of severity are defined. Deformations should be noted when it is extensive enough to warrant complete shoulder rehabilitation.

How to Measure: Generally, rate the righthand shoulder. If a difference exists in the lefthand shoulder, note under remarks. Checkmark the appropriate category.

DISTRESS	SEVERITY		SECTION (1)	(2)	(3)	(4)	(5)	EXTENT TOTAL		REMARKS
		Beginning	1000	1005	1010	1015	1020			
		Ending	1005	1010	1015	1020	1025	SUM	%	
SHOULDER DEFORMATION ☑	N	None	✓	✓		✓	✓	4	80	
	P	Present			✓			1	20	

$$\% = \frac{\text{Sum of Checkmarks}}{\text{Number of Sections Evaluated}} \times 100$$

Figure D4 - Shoulder Deformation

SHOULDER SURVEY PERTINENT TO: BOTH [✓] RIGHT [ ] LEFT [ ]

SHOULDER DETERIORATION ✓	N	None	✓	✓	✓	✓		4	80	
	L	Single Crack						0	0	
	M	Multiple Cracks					✓	1	20	
	H	Mult. Cracks w/Potholes						0	0	
LANE/SHOULDER SEPARATION (MEASURE) ✓	N	None						0	0	
	L	< 1/4"/Sealed						0	0	
	M	1/4"–1"				✓	✓	2	40	
	H	> 1"	✓	✓	✓			3	60	
LANE/SHOULDER DROPOFF (MEASURE) ✓	N	None	✓	✓	✓			3	60	
	L	< 1"						0	0	
	M	1"–2"				✓	✓	2	40	
	H	>2"						0	0	
SHOULDER DEFORMATION ✓	N	None	✓	✓		✓	✓	4	80	
	P	Present			✓			1	20	